OPERATION AND SERVICE MANUAL

MODEL 4045AI

AC/DC JUNIOR HYPOT®

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SECTION I

OPERATORS MANUAL

INTRODUCTION

This manual discusses the reasons why dielectric withstand tests are required, the precautions necessary to ensure that the tests are done safely, and how such tests are accomplished on various classes of materials, components and products.

In later chapters, the features of this Associated Research Model Hypot® are explained, along with a step by step guide to its proper use. Finally, technical data is presented.

SAFETY PRECAUTIONS REQUIRED FOR HIGH VOLTAGE TESTING

WARNING: A Hipot produces voltages and currents which can cause **harmful or fatal electric shock.** To prevent accidental injury or death, these safety procedures must be strictly observed when handling and using the test instrument.

SERVICE AND MAINTENANCE

User Service
To prevent electric shock do not remove the instrument cover. There are no user serviceable parts inside. Refer servicing to an Associated Research, Inc. authorized service center. Schematics, when provided, are for reference only.

Service Interval
The instrument and its power cord, test leads, and accessories must be returned at least once a year to an Associated Research authorized service center for calibration and inspection of safety related components. Associated Research will not be held liable for injuries suffered if the instrument is not returned for its annual safety check and maintained properly.

User Modifications
Unauthorized user modifications will void your warranty. Associated Research will not be responsible for any injuries sustained due to unauthorized equipment modifications or use of parts not specified by Associated Research. Instruments returned to Associated Research with unsafe modifications will be returned to their original operating condition at your expense.

TEST STATION

Location
Select an area away from the main stream of activity which employees do not walk through in performing their normal duties. If this is not practical because of production line flow, then the area should be roped off and marked for HIGH VOLTAGE TESTING. No employees other than the test operators should be allowed inside.

If benches are placed back-to-back, be especially careful about the use of the bench opposite the test station.

Power
Dielectric Voltage Withstand Test Equipment must be connected to a good ground. Be certain that the power wiring to the test bench is properly polarized and that the proper low resistance bonding to ground is in place.

Some testers incorporate monitor circuits which check the connections to the power line and ground. The lights on these line monitors show at a glance if the wiring is correct or if the polarity is wrong, ground missing, etc. If the line monitor shows

a fault condition, turn off and unplug the tester and do not use it until the wiring is repaired.

Power to the test station should be arranged so that it can be shut off by one prominently marked switch located at the entrance to the test area. In the event of an emergency, anyone can cut off the power before entering the test area to offer assistance.

Work Area

Perform the tests on a nonconducting table or workbench, if possible. If you cannot avoid using a conductive surface, be certain that it is securely grounded to a good earth ground and insulate the high voltage connection from the grounded surface.

There should not be any metal in the work area between the operator and the location where products being tested will be positioned. Any other metal in the work area should be connected to a good ground, never left "floating".

Position the tester so the operator does not have to reach over the product under test to activate or adjust the tester.

Keep the area clean and uncluttered. All test equipment and test leads not absolutely necessary for the test should be removed from the test bench and put away. It should be clear to both the operator and to any observers which product is being tested, and which ones are waiting to be tested or have already been tested.

Do not perform Hipot tests in a combustible atmosphere or in any area where combustible materials are present.

TEST OPERATOR

Qualifications

This instrument generates voltages and currents which can cause **harmful or fatal electric shock** and must only be operated by a skilled worker trained in its use.

The operator should understand the electrical fundamentals of voltage, current, and resistance. They should recognize that the test instrument is a variable high-voltage power supply with the return lead directly connected to earth ground and therefore, current from the high-voltage output will flow through any available ground path.

Safety Procedures

Operators should be thoroughly trained to follow these and all other applicable safety rules and procedures before they begin a test. Defeating any safety system should be treated as a serious offense and should result in severe penalties, such as removal from the Hipot testing job. Allowing unauthorized personnel in the area during a test should also be dealt with as a serious offense.

Dress
Operators should not wear jewelry which could accidently complete a circuit.

Medical Restrictions
This instrument should not be operated by personnel with heart ailments or devices such as pacemakers.

TEST PROCEDURES

!NEVER PERFORM A HIPOT TEST ON ENERGIZED CIRCUITRY OR EQUIPMENT!

Connect the return (ground) lead **first** for any test regardless of whether the item under test is a sample of insulating material tested with electrodes, a component tested with the high voltage test lead, or a cord-connected device with a two or three prong plug.

Plug in the high voltage test lead only when it is being used. Handle its clip only by the insulator---**never touch the clip directly.**

Be certain that the operator has control over any remote test switches connected to the Hipot.

Before turning on the Hipot, rotate the voltage control to its maximum counterclockwise position. Double check the return (ground) and high voltage connections to be certain that they are proper and secure.

Never touch the item being tested or anything connected to it during the Hipot test.

At the end of a test, once again rotate the voltage control to its maximum counterclockwise position and check the meter to be sure the voltage across the item under test has dropped to zero before disconnecting the test leads. When testing with DC, always discharge the capacitance of the item under test and anything the high voltage may have contacted--such as test fixtures--before handling it or disconnecting the test leads.

HOT STICK probes can be used to discharge any capacitance in the item under test as a further safety precaution. A hot stick is a nonconducting rod about two feet long with a metal probe at the end which is connected to a wire. To discharge the device under test, two hot sticks are required. First connect both probe wires to a good earth ground. Then touch one probe tip to the same place the return lead was connected. While holding the first probe in place, touch the second probe tip to the same place where the high voltage lead was connected. Again, check the meter to be sure the voltage has dropped to zero.

WHY PERFORM DIELECTRIC WITHSTAND TESTS?

A dielectric withstand test is a deliberate application of a higher-than-normal potential across some insulating material or the entire insulation system of a component or device. This stresses the insulation and the intent is to verify that the insulation can take this stress without breaking down and allowing arcing, and without drawing excessive current. If the insulation passes the test, it is assumed that it will withstand the lesser stress of its intended application. The test can uncover defects in material or workmanship which would render the insulation system ineffective if not corrected.

The items most commonly subjected to dielectric withstand tests fall into four categories:

I. Insulating raw materials: solids, liquids, gases.

II. Components: switches, relays, transformers, circuit breakers, potentiometers, wire, cable, connectors, etc.

III. End Products: appliances, motors, instruments, office machines, the control equipment of aircraft, machine tools, etc.

IV. Repaired or rebuilt products: rewound motors, generators, transformers, repaired appliances and entertainment devices, etc.

The majority of the tests performed can be grouped into the following categories:

I. Design Tests: A manufacturer desiring to verify the insulation provided by a supplier or designed into his product may run tests in a laboratory environment. Such tests may be designed to stress insulation or insulation systems against either the supplier's or the manufacturer's own specifications, or during component selection to gauge the relative insulation quality of competing products.

II. Routine Production tests: A manufacturer may conduct tests at various points in the production of his products to uncover defects in material or workmanship and prevent the defective product from receiving further processing. Often a regulatory agency or independent testing lab will require specific tests on completed products immediately prior to packaging for shipment. The products must pass these tests as a condition for "listing" or "recognition" or "certification" or even for permission to offer the product for sale.

III. Acceptance Tests: A purchaser may conduct tests on purchased components to prove that they meet minimum insulation specifications, to prevent faulty components from being incorporated into his own products.

IV. Service or Maintenance Tests: The owner of a piece of equipment may wish to periodically verify the integrity of its insulation system, to determine whether or not deterioration has taken place, and to what extent. A rebuilder of motors, etc., may wish to verify that his work was done properly by performing tests on the rebuilt equipment. A repairer of appliances, entertainment devices, etc., may wish to verify that he has not degraded the insulation system of any item he has repaired and to give the owner some minimum assurance of safety.

TYPICAL APPLICATIONS

To insure that the insulation or insulation system is properly stressed during a dielectric withstand test, the voltage must be applied across the insulation. This would not be the same connection as is normally used to power up the device being tested. For each of the categories of items mentioned earlier, we will discuss the usual application of the test potential:

I. Insulating raw materials: In general, the test voltage is applied to the test sample by placing the sample between two metallic electrodes connected to the Hypot® output. Of course, the size and shape of the electrodes must be proper for the type and amount of material being tested, and for testing liquids or gases, suitable containers must also be used.

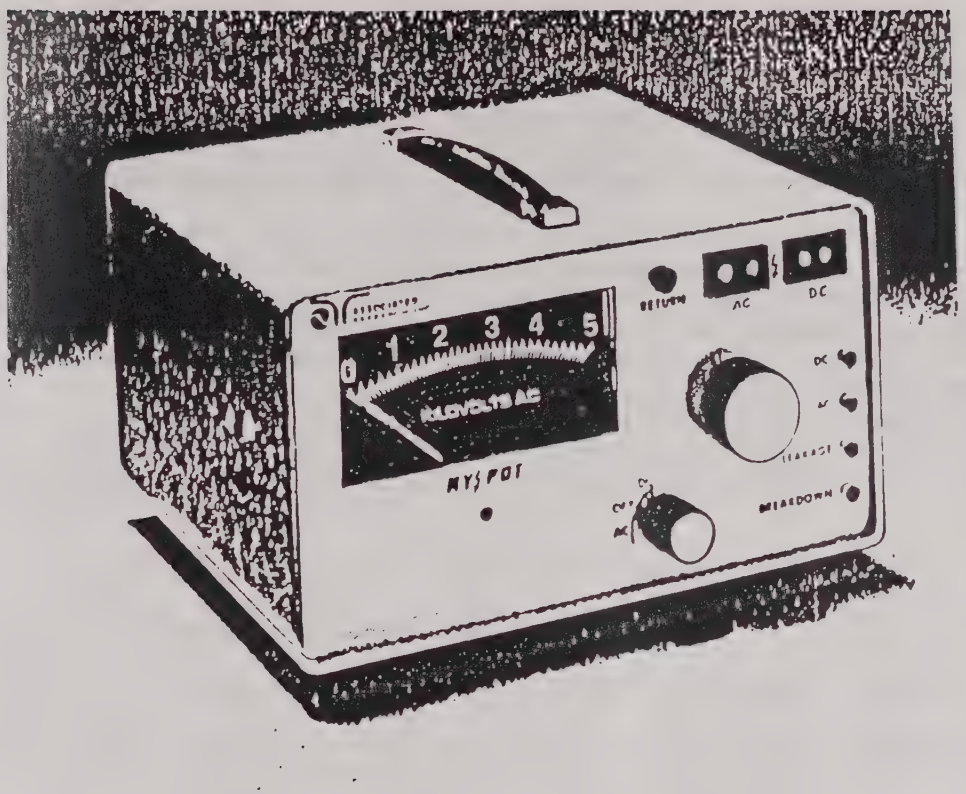
II. Components: Most often the tests required for components test the insulation between parts which are normally conducting and parts which are normally isolated and non-conducting or grounded. For example, in testing a potentiometer, the three potentiometer terminals would normally be shorted together and connected to the high voltage lead, and the case of the potentiometer would be connected to the ground lead. Sometimes, as in the case of transformers and motors, additional tests are required between normally conducting parts which must be kept insulated from each other. A simple transformer, for example, would receive three tests: primary to frame, secondary to frame, and primary to secondary. When testing transformers, it is common and recommended practice to tie both ends of a winding together before applying one side of the nigh voltage. It is not the continuity of the winding which is being tested, but the insulation

from every part of the winding to other components of the transformer. Similar treatment is usually given any winding, coil or heating element in a component, because over-voltaging these parts is not generally part of the Hypot® test.
Switches and relays, in addition to being tested from conducting parts to dead parts, are often also tested across open contacts. A special electrode may be required to test resistors, capacitors and similar items when it is desired to test the insulation provided by a coating or molded case. The special electrode, touching the outside of the case, is one connection point. The other is the leads of the device, all shorted together.

III. End products: These are typically cord-connected finished products. The double-insulated variety must be tested with special electrodes touching the outside of the case connected to one side of the Hypot® and both blades of the line cord connected together and to the other side of the Hypot®. Any device with metal parts on its exterior should have the return (ground) lead connected to those metal parts (all connected together at once, or sequentially) and the high voltage applied to both blades of the line cord shorted together. For any testing of cord-connected end products, always leave the power switch(es) on so that the entire line circuit will be tested. If the device does not have a neutral connection, and the ground connection normally carries current, it will fail a Hypot® test from line to ground unless the connection from the internal wiring to ground is temporarily lifted during the test. Combination 240-120V appliances are often of this nature.

IV. Repaired or rebuilt products: The same techniques are generally used as on new equipment, except that the test voltage or time is sometimes reduced.

The voltage used and the time for which it is applied are sometimes specified by the manufacturer of an insulating material or by a regulatory or testing agency. When they are not, the following "rule of thumb" is often used: determine the voltage(s) in the circuit(s) being tested, under normal operating conditions. For a circuit to circuit test, as in a transformer, the voltage will depend on the degree of isolation required between circuits. For a circuit to ground or circuit to dead metal test, use two times the normal voltage plus 1000V. For example, a household iron rated at 120V would normally be tested at 1240V.



1. Wide, easily read 4-1/2 inch AC/DC kilovoltmeter with 2% of full scale accuracy.

2. Detachable 5 foot return (ground) lead. This lead is always used in performing tests and is grounded for safety.

3. Detachable 5 foot high voltage lead with flexible rubber insulation for easy handling. Control panel jacks are well recessed for safety.

4. Lighted AC and DC indicators on the control panel which show that the High Voltage circuit is enabled ("Power On") and indicate which mode of operation was selected by rotating the power switch to either the AC or DC position.

5. Lighted Breakdown and Leakage indication. If excessive current is drawn during the Hypot® test, the yellow leakage indicator will illuminate and an audio alarm will sound. Should any arcing occur during the Hypot® test, both the yellow leakage indicator and the orange breakdown indicators will illuminate. To reset the unit, simply decrease the output voltage to zero, place the power switch into the "Off" position and remove whatever is causing the failure from the output leads.

6. Voltage adjust knob. This control varies the high voltage from near zero to the full 5000 volts AC or 5000 volts DC. The voltage can be adjusted only when the high voltage circuit is energized. It is recommended that the voltage control be returned to zero at the end of each test.

7. Detachable 7-1/2 foot power cord with standard connector.

8. Line fuse accessible from the rear. "Shock safe" fuseholder.

9. Separate AC and DC Current Trip (sensitivity) adjustments. The current at which the Failure alarm will trip is adjustable from approximately .3 mA to 5 mA AC or 3 mA DC. Turn the controls counterclockwise to decrease the current setting and increase sensitivity. Turn them clockwise to increase the current setting and decrease sensitivity.

OPERATING INSTRUCTIONS

WARNING: DANGER - HIGH VOLTAGE - improper grounding or careless handling of the test set could result in dangerous shock hazard. Use extreme caution when operating.

1. Locate the Junior Hypot® in a suitable area for performing tests. There should be adequate light and power available. Allow sufficient room for the devices to be tested in such a way that the connections to them will be straightforward and uncrowded and all personnel will be able to stay clear during the tests. The surface upon which the tests will occur should be of a non-conductive material. If a conductive surface must be used, it should be securely electrically tied to a good earth ground and the high voltage connection will need to be properly insulated from ground.

2. Be sure the power switch is in the "Off" position.

3. Install and connect the line cord.

4. Connect the return lead to the Junior Hypot® and to the item to be tested.

5. Connect the high voltage lead to either the AC or DC high voltage output of the Junior Hypot® as required and to the item to be tested.

6. Rotate the Voltage Control of the Junior Hypot® fully counterclockwise. This adjusts the high voltage output to near zero when the test set is energized.

7. Place the power switch into either the AC or DC positions as required to energize the high voltage circuit. Do not handle the test leads or touch the item under test once the high voltage circuit is energized.

8. Rotate the voltage control of the test set clockwise while observing the kilovoltmeter until the desired test voltage is indicated. Start timing when the proper voltage is reached. If there has been no failure indication at the end of the timing period, the item under test has passed.

9. Rotate the voltage control fully counterclockwise.

10. Place the power switch into the "Off" position.

11. By observing the kilovoltmeter, verify that the high voltage has dropped to zero before disconnecting the item under test. NOTE: When DC testing items of a capacitive nature allow extra time for the item to discharge through the metering system of the Junior Hypot®. When the kilovoltmeter of the test set reads zero, the item under test should be discharged and safe to handle.

12. If the total test voltage can be applied instantaneously, the voltage control may be left at the proper setting and testing can be accomplished by turning the power switch to the "AC" or "DC" position as required after the connections to the item under test have been made and the test

area is clear. Monitor the voltage on the kilovoltmeter as high voltage will energize instantly and remain on until turned off by the operator. If the voltage must be applied gradually, steps 8 and 9 must be repeated.

13. If a test item failure occurs (excessive leakage current or break down [arcing]), the failure detection system will instantly indicate the nature of the failure by illuminating either the leakage or breakdown lamps and activating an audible alarm. Both the visual and audible indications will remain active and conspicuous until the failure conditions are removed from the output of the Junior Hypot®.

14. Always place the power switch into the "Off" position before connecting or disconnecting a test item. WARNING: FAILURE TO DO SO MAY RESULT IN A DANGEROUS SHOCK HAZARD. WILL SHOCK, BURN OR CAUSE DEATH.

CURRENT TRIP (SENSITIVITY) ADJUSTMENT AC AND DC

(0.3mA to 5mA range)

The failure detection systems for both the AC and DC modes have been preset so that at 1 mA, or more of output current, the alarm will sound and the leakage lamp will illuminate. If this factory setting is not appropriate for the intended application, it can be reset as follows:

1. Select a value of resistance which must trigger the failure circuit of the Junior Hypot®. The value of the resistance may be determined using the following formula:

   $$\frac{\text{Voltage at which the test is being made}}{\text{current which must trigger failure.}} = \text{Value of Resistance}$$ Minimum

2. Place the power switch of the Junior Hypot® into the "Off" position and rotate the voltage control to its extreme counterclockwise position.

3. Connect the test leads to the Junior Hypot® output receptacles.

4. Connect the resistance chosen in step #1 across the test leads of the Junior Hypot®. The surface on which the test set is located should be non-conductive. If conductive, the surface must be grounded securely and the test leads isolated from ground.

5. Place the power switch of the Junior Hypot® into the "On" position.

6. Rotate the voltage control of the test set clockwise while observing the kilovoltmeter until it indicates the voltage used in selecting the resistance value in step #1. If the Junior Hypot® indicates a failure before the test voltage is reached, the current sensitivity setting is too low. Choose either the AC or DC current trip adjustment located on the rear panel as required and rotate it either clockwise to decrease the sensitivity, or counterclockwise to increase the sensitivity setting.

7. When the failure detection system is activated, rotate the voltage control counterclockwise until the failure is automatically cancelled.

8. Recheck the setting of the failure detector by slowly rotating the voltage control clockwise while observing the kilovoltmeter. The failure detector should be activatged when the proper test voltage is reached. If not, repeat steps #6 through 8.

9. Return the voltage control to its extreme counterclockwise position and place the power switch into the "Off" position before diconnecting the test leads.

S P E C I F I C A T I O N S :

MODEL NUMBER:	04045AI
DESCRIPTION:	AC/DC Junior Hypot
PRIMARY APPLICATION:	Laboratory evaluation of dielectric strength of components, insulation systems, etc.
INPUT:	
Voltage:	115 Volts AC
Frequency:	50/60 Hz
Phase:	Single
Current:	1 A
OUTPUT:	
Voltage:	0-5KV AC/DC.
KVA:	.0125
Frequency:	50/60 Hz and DC
Current:	.3-5mA AC and .3-3mA DC
Duty Cycle:	Continuous
Failure Detector:	Current and arc sensitive failure system in return side of output. Continuously adjustable current sensitivity from .3-5 milliamperes. Factory set at 1 mA.
VOLTAGE CONTROL:	Manually operated, continuously adjustable from zero to maximum output.
METERING KILOVOLTMETER:	Analog -- 0-5 KV AC/DC with 100 volts reading resolution.
TERMINATION:	
Input:	Detachable 7-1/2 foot 3 conductor power cable terminated in 3 prong grounding type plug.
HIGH VOLTAGE:	Detachable five foot silicon rubber insulated cable terminated in clip with rubber insulation.
RETURN:	Detachable five foot cable terminated in clip with rubber insulation.
CABINETRY:	Portable type with handle - 10.825"x9"x5.825" (274.95 mm x 228.60 mm x144.95 mm)
WEIGHT:	13.0 lbs. (5.9 Kg)

SECTION II

REPLACEMENT PARTS LIST

To order replacement parts, refer to the Replacement Parts List on the following pages. If you need assistance, call our Technical Support Hotline 1-800-858-TEST.

REPLACEMENT PARTS LIST

SYM	PART #	DESCRIPTION	QTY
AL	35520	Alarm, Piezo	1
C-1	35216	Capacitor 2200 MFD, 25V	1
C-2	58168	Capacitor .002 MFD. 2kV.	1
C-3	11831	Capacitor .1 MFD, 5kV	1
C-4	35634	Capacitor Cer. .01 MFD 50 V	1
C-5	35635	Capacitor, Film, .1 MFD 100V	1
D-1-3,11	35214	Diode IN4001	4
D-4	16379	Diode HV, 20kV	1
D-5,6	34934	Diode Led Red	2
D-7	35767	Diode Led Yellow	1
D-8	35884	Diode Led Orange	1
D-9,10	14503	Diode 1N4006	2
F-1	17755	Fuse 1A 250V, SLO-BLO	1
	35458	Fuse Holder, PCB Mtg.	1
	35457	Fuse Carrier	1
K-1	35435	Relay Reed SPST	1
L-1	11155	Choke Fxd. 2.5MHF	1
M-1	04045AI-14	Meter Assembly	1
P-1	35473	Conn. Male 3 Post HD.	1
P-2	35886	Conn. Male 11 Post HD.	1
P-3	35670	Conn. Male 10 Post HD	1
P-4	35492	Recept, Male 250V	2
R-1	16123	Resistor Fxd 100 Ohm, 1/2W, 1%	1
R-2	15294	Res. Fxd 499 Ohm, 1/2W, 1%	1
R-3	17073	Res. Fxd 316 Ohm, 1/2W, 1%	1
R-4	35092	Res. Fxd 10K ohm, 1/4W, 1%	1
R-5	16208	Res. Var. 1.5K, 1/8W, 30%	1

REPLACEMENT PARTS LIST - Continued

SYM	PART #	DESCRIPTION	QTY
R-6,7,8,9	34878	Res. Fxd 12.1K ohm, 1/2W, 1%	4
R-10	58114	Res. Fxd 150K ohm, 1/2W, 1%	1
R-11	34509	Res. Fxd 24.9K ohm, 1/2W, 1%	1
R-12, 18	36903	Res. Fxd 18 Meg Ohm, 2.5 W 1%	2
R-13,14	35495	Res. Var. 500K Ohm, 2W, 10%	2
R-15	35891	Res. Var. 10K ohm, 1/4W, 10%	1
R-16	35633	Res. Var. 200K ohm, 1/4W, 10%	1
R-17	11821	Res. Fxd 49.9K ohm, 1/2W, 1%	1
S-1	36891	Switch, Rot. 4P 3 Pos.	1
T-1	35441	Transformer Var. 0-120VAC	1
T-2	35868	Transformer H.V. 115V, 5kV	1
T-3	35842	Transformer PWR. 115/230V-16V	1
U-1	34935	IC Volt-Reg. LM 340-AT5	1
U-2,4	35505	IC Optoisolator	2
U-3	35251	IC Timer 555	1
VR-1	19840	Varistor 130V	1
VR-2,3	35823	Varistor 20MM 130V	2
VR-4	35758	Varistor 250V	1
	33189	Cable Input 7.5 Ft	1
	35464	Heat Sink	1
	35498	Tab. .110 Faston PCB Mtg.	2
	35499	Tab, Single .187 Faston PCB Mtg	6
	35500	Tab, Double .187 Faston PCB Mtg.	3
	04045AI-12	High voltage Cable Assy	1
	04040A-09	Return Cable Assy	1

SECTION III

CALIBRATION PROCEDURE

ASSOCIATED RESEARCH, INC.	CALIBRATION PROCEDURES	PROCEDURE#
		ISSUE DATE
		REVISION#
	MODEL NUMBER 04045AI	REVISION DATE
		PAGE 1 OF 6

KILOVOLTMETER CALIBRATION

Equipment needed: 23.5 Megohm Multiplier (Firecracker), Kiethley 197 Digital Multimeter with multiplier assembly.

1. Connect the co-axial cable output of the 23.5 Megohm Firecracker to the input of the multiplier assembly of the DMM.

2. Place the AC/DC switch of the multiplier assembly into the "AC" position.

3. Connect the DMM input leads between the input jacks of the DMM and the output jacks of the multiplier assy.

4. Place the power switch of the DMM into the "ON" position.

5. Set the DMM for "AC volts" operation.

6. Set the DMM for the 0-200 V range.

7. Connect the AC High Voltage Output of the unit to be calibrated to the High Voltage Terminal of the Firecracker.

8. Connect the Return of the unit to be calibrated to the ground terminal of the Firecracker.

9. Mechanical zero adjust the Kilovoltmeter of the unit to be calibrated for zero. Tap the meter to make the pointer bounce and confirm that it returns to zero. If not, re-adjust and repeat.

10. Rotate the voltage control of the unit to be calibrated to its extreme counterclockwise position and place the power switch into the "OFF" position.

11. Plug the unit to be calibrated into a 115 VAC 60 Hz outlet and place its power switch into the "AC" position. CAUTION: Always adjust the voltage control to its extreme counterclockwise position before energizing the unit, otherwise there will be high voltage at the output terminals.

12. Rotate the voltage control clockwise until the DMM shows an indication of 50 V volts $\pm$ .10 volt.

13. Adjust the calibration potentiometer R_{16} on the printed circuit board of the unit for a 5 kV (full scale) reading on the unit's meter.

14. Check the tracking at all major points. Tracking must be within a tolerance of $\pm$ 2% of the full scale reading at each point ($\pm$ 1.0 volts).

15. Rotate the voltage control of the unit to be calibrated to its extreme counterclockwise position and place the power switch into the "Off" position.

16. Apply glyptol to potentiometer R_{16}.

17. Place the AC/DC switch of the multiplier assembly into the "DC" position.

18. Set the DMM for "DC volts" operation.

19. Connect the DC High Voltage Output of the unit being calibrated to the High Voltage Terminal of the Firecracker.

20. Place the power switch of the unit being calibrated into the "DC" position.

21. Rotate the voltage control clockwise until the DMM shows an indication of 50 volts $\pm$ .10 volt.

22. Adjust the calibration potentiometer R_{15} for a 5 kV (full scale) reading on the unit's meter.

23. Check the tracking of the meter at all major points. Tracking must be within a tolerance of $\pm$ 2% of the full scale reading (1.0 volts) at each point.

24. Rotate the voltage control of the now calibrated unit to its extreme counterclockwise position and place the power switch into the "off" position.

25. Disconnect the calibrated unit from the Firecracker and apply glyptol to potentiometer R_{15}.

FAILURE DETECTION RANGE CHECK & FACTORY SETTING - AC

Equipment Needed: 15 Megohm 1% Load Resistor, 1 Megohm 1% Load Resistor, 2 Megohm 1% Load Resistor, Kiethley 197A Digital Multimeter

1. Connect the AC High Voltage Output of the unit to be calibrated to one lead of the 15 Megohm Load Resistor.

2. Connect the Red lead of the DMM to the free lead of the 15 Megohm load.

3. Connect the Black lead of the DMM to the Return of the unit to be calibrated. NOTE: When using the Kiethley DMM in the current mode, always use special test leads with a diode shunt network. These are to protect the instrument against damage in case of error in mode selection.

4. Place the power switch of the DMM into the "ON" position.

5. Set the DMM for "AC Current" operation.

6. Select the 20 mA range of the DMM. CAUTION: When selecting ranges on the Kiethley 197A DMM for current operation be absolutely sure that there is no voltage present at its input terminals. The act of changing current ranges on the DMM while measuring an energized circuit will result in damage to the DMM. Therefore, always de-energize the circuit under test before changing current ranges.

7. Place the voltage control of the unit to be calibrated into its extreme counterclockwise position.

8. Place the power switch of the unit to be calibrated into the "AC" position.

9. Rotate potentiometer R_{14} to its extreme counterclockwise position.

10. Slowly rotate the voltage control of the unit to be calibrated clockwise while observing the readout of the DMM.

11. The Failure Detector should be activated before the DMM shows a reading of .3 mA. When the Failure Detector is activiated simply rotate the voltage control counterclockwise until the audible/visual failure is automatically cancelled.

12. Place the voltage control of the unit to be calibrated into its extreme counterclockwise position and place the unit's power switch into the "Off" position.

13. Remove the 15 Megohm load and replace it with a 1 Megohm load resistance.

14. Rotate potentiometer R_{14} to its extreme clockwise position.

15. Place the power switch of the unit to be calibrated into the "AC" position.

16. Slowly rotate the voltage control of the unit being calibrated clockwise while observing the readout of the DMM.

17. The Failure Detector should not be activated until the DMM indicates some value higher than 5 mA. When the Failure Detector is activated simply rotate the voltage control counterclockwise until the audible/visual failure is automatically cancelled.

18. Rotate the voltage control of the unit being calibrated to its extreme counterclockwise position and place the power switch into the "Off" position.

19. Remove the 1 Megohm load and replace it with a 2 Megohm load resistance.

20. Place the power switch of the unit being calibrated into the "AC" position and rotate the voltage control clockwise until a reading of 1 mA is indicated on the DMM.

21. Slowly rotate potentiometer R_{14} counterclockwise until the Failure Detector is activated.

22. Rotate the voltage control of the unit being calibrated counterclockwise until the audible/visual failure is cancelled; then rotate the voltage control control clockwise again to confirm the 1 mA setting.

23. Rotate the voltage control of the unit being calibrated to its extreme counterclockwise positon, place the power switch in the "Off" position, and disconnect the unit from the setup.

FAILURE DETECTOR RANGE CHECK AND FACTORY SETTING - DC

Equipment needed: 15 Megohm 1% load resistor, 1.5 Megohm, 1% load resistor, Kiethley 197A Digital Multimeter.

1. Connect the DC High Voltage output of the unit being calibrated to one lead of the 15 Megohm load resistor.

2. Connect the Red lead of the DMM to the free lead of the 15 Megohm load.

3. Connect the Black lead of the DMM to the Return of the unit being calibrated. NOTE: When using the Kiethley DMM in the current mode always use special test leads with a diode shunt network. These are to protect the instrument from damage in case of error in mode selection.

4. Place the power switch of the DMM into the "On" position.

5. Set the DMM for "DC Current" operation.

6. Select the 20 mA range of the DMM. CAUTION: When selecting ranges on the Kiethley 197A DMM for current operation be absolutely sure that there is no voltage present at its input terminals. The act of changing current ranges on the DMM while measuring an energized circuit will result in damage to the DMM. Therefore, always de-energize the circuit under test before changing current ranges.

7. Place the voltage control of the unit to be calibrated into its extreme counterclockwise position.

8. Place the power switch of the unit to be calibrated into the "DC" position.

9. Rotate potentiometer R_{13} to its extreme counterclockwise position.

10. Slowly rotate the voltage control of the unit being calibrated clockwise while observing the readout of the DMM.

11. The Failure Detector should be activated before the DMM shows a reading of .3 mA. When the Failure Detector is activated simply rotate the voltage control counterclockwise until the audible/visual failure is automatically cancelled.

12. Place the voltage control of the unit being calibrated into its extreme counterclockwise position and place the unit's power switch into the "Off" position.

13. Remove the 15 Megohm load and replace it with a 1.5 Megohm load resistance.

14. Rotate potentiometer R_{13} to its extreme clockwise position.

15. Place the power switch of the unit to be calibrated into the "DC" position.

16. Slowly rotate the voltage control of the unit being calibrated clockwise while observing the readout of the DMM.

17. The Failure Detector should not be activated until the DMM indicates some value higher than 3 mA. When the Failure Detector is activated simply rotate the voltage control counterclockwise until the audible/visual failure is automatically cancelled.

18. Rotate the voltage control of the unit being calibrated to its extreme counterclockwise position and place the power switch into the "Off" position.

19. Remove the 1.5 Megohm load and replace it with a 2 Megohm load resistance.

20. Place the power switch of the unit being calibrated into the "DC" position and rotate the voltage control clockwise until a reading of 1 mA is indicated on the DMM.

21. Slowly rotate potentiometer R_{13} counterclockwise until the Failure Detector is activated.

22. Rotate the voltage control of the unit being calibrated counterclockwise until the audible/visual failure is cancelled, then rotate the voltage control clockwise again to confirm the 1 mA setting.

23. Rotate the voltage control of the now calibrated unit to its extreme counterclockwise position, place the power switch into the "Off" position and remove the unit from the calibration setup.

HYPOT TEST

Equipment needed: AC Hypot Test Set Model 4040A

1. Connect a line cord to the input receptacle of the Model 4045AI to be tested.

2. Connect the input plug of the unit to be tested to the High Voltage Receptacle of the Hypot Test Set.

3. Connect the Return/Continuity lead of the Hypot Test Set to the chassis of the unit to be tested.

4. Place the power switch into either the "AC" or "DC" positions.

5. Activate the Continuity Test system of the Hypot Test Set by depressing the Continuity Test button. This should illuminate the lamps in both the Continuity Test Button and the Push to Test button. If the lamp in the Push to Test button is not illuminated, change the placement of the Return/Continuity lead until ground continuity is established.

6. Energize the High Voltage Output of the Hypot Test Set by depressing the Push to Test button of the test set. This will apply the high voltage only if ground continuity exists. Adjust the output of the Hypot Test Set for 1200 V. This is to be applied for one (1) second to the item under test without electrical breakdown.

7. De-energize the Hypot Test Set by releasing the Push to Test button and disconnect the tested unit from the test set.

SECTION IV

SCHEMATIC

MP MASTER
MA30086